

Effects of Cultivation Methods on Paddy Rice Growth Observed by UAV-mounted Multispectral Camera

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Remote sensing technology is effective for monitoring paddy rice growth and yield estimation. Vegetation indices (VIs) obtained from remote sensing data are related to rice grain protein content, which is an indicator of rice taste and has been used to estimate the best harvesting time. It is observed that the red-edge band spectrum is sensitive to chlorophyll and nitrogen content, the reflectance from the plants changes rapidly in this spectral region, and the VI obtained using the red-edge band is less saturated than that obtained using the red band. In this study, considering that different cultivation methods affect rice growth, we compared the VI based on the red-edge band with two other VIs based on red and green bands to observe the differences in the growth of paddy rice in conventional and organic farming paddy plots. We captured images using an unmanned aerial vehicle (UAV) mounted multispectral camera, on August 5, August 22, and September 13, 2022, in a paddy field located at the Kawatabi Field Science Center of Tohoku University in Osaki City, Miyagi Prefecture, Japan. The drone DJI Inspire 2 was equipped with a RedEdge-MX Dual camera, which can observe in 10 bands. As a result, the mean values of all three VIs showed a decreasing tendency with increasing growth period. Growth difference between conventional and organic cultivation methods were more pronounced for the VI obtained using the red-edge band compared with the VIs obtained using green and red bands. The difference between the two cultivation methods was apparent before the heading date, and it became difficult to discern thereafter. The values of the VIs in conventional farming were larger than those in organic farming.